

REMARKS

Applicant has amended the Abstract to include an example of a "thermolabile molecular halogen precursor."

Applicant has also amended claims 16 and 18 to address the Examiner's objections on page 2 of the Office Action.

The Examiner states that JP-918 describes a method for removing mercury out of the exhaust gas emitted from an incinerator by passing the mercury and sulfur dioxide contaminated exhaust gas through a wet scrubber which sprays an aqueous solution of calcium hypochlorite into the gas. The Examiner states that the difference between Applicant's claims and JP-918 is that Applicant's independent claims call for the provision of alkaline solids in the exhaust gas. The Examiner further states that Galbraith et al. report that $Hg^{2+}X$ gas emissions can be sorbed onto fly ash particle surfaces. Therefore, the Examiner concludes that it would have been obvious to one of ordinary skill in the art to modify the process described in JP-918 by providing coal fly ash particles into the exhaust gas of JP-918.

In JP-918 mercury and nitrogen oxides are removed from exhaust gases by an absorption solution. Referring to the English abstract of JP-918, means are disclosed for "removing mercury and nitrogen oxide(s) simultaneously from waste gas - using hypochlorite or chlorite containing

solution as adsorbent" (emphasis added). The English abstract of JP-918 also describes the invention as follows:

"Hg and/or NO_x in waste gas are absorbed in a hypochlorite or chlorite containing soln.

An absorption soln. contg. several ppm to several hundred ppm hypochlorite and/or chlorite as effective chlorine is used at a pH of 3-8"

(emphasis added).

In addition, Figs. 1-4 of JP-918 depict exhaust gases passing through a hypochlorite or chlorite solution. For example, referring to Fig. 1 of JP-918, exhaust gas containing Hg and NO_x is guided into exhaust gas washing column 21, and absorbing solution comprising alkali washing solution with hypochlorite or chlorite is circulated by a pump 22, exhaust gas being washed and treated. Thus Hg and NO_x are removed from the exhaust gas simultaneously.

Figures 1-3 of JP-918 illustrate the circulation or recycling of an aqueous solution of hypochlorite or chlorite such as NaClO (sodium hypochlorite). In Figure 1 the aqueous solution is circulated by a pump 22 into a wash tower 21 in which the solution is sprayed countercurrent to the direction of a flue gas. In Figure 2 the aqueous solution is circulated by pump 26 into a wash tower 24. In Figure 3 the solution is circulated by a pump 29. In addition, Figures 3 and 4 of JP-918 disclose passing exhaust gases through the chlorite or hypochlorite containing solution.

JP-918 does not disclose absorption of Hg or NO_x from exhaust gases by anything other than hypochlorite or chlorite containing solution. In order for a chlorite or hypochlorite containing solution to be circulated, or for exhaust gases to be passed through such a solution, it must never exceed approximately 100°C, the boiling point of the solution. If the temperature of the chlorite or hypochlorite solution were to exceed 100°C it would be converted to vapour and would escape with the exhaust gases. In addition, the portion of chlorite or hypochlorite unreacted with mercury, sulphur dioxide or nitrogen oxides must remain essentially stable (i.e. undecomposed for pump recycle).

Therefore, Applicant submits that the invention of JP-918 only works at temperatures below the boiling point of water since "absorbing solutions" do not exist above the boiling point of water.

At page 6, line 27 to page 9, line 4 of the present application the treatment of flue gas with a source of molecular halogen is discussed. The present application clearly identifies molecular halogens as "chlorine gas and/or bromine gas and/or iodine." It shows that "molecular halogens can be used alone or in combination with molecular halogen precursors." (see page 7, lines 7-8). It describes "thermolabile halogen species able to decompose thermally at flue gas temperatures" and gives examples of thermolabile halogen precursors, (see Table 1)

which decompose at temperatures at or above the boiling point of aqueous solutions (see page 7, lines 11-17).

Furthermore, the present application illustrates that the chemical reaction of a thermolabile halogen precursor with mercury is via its molecular halogen thermal decomposition product (e.g. chlorine Cl₂) (see page 8, lines 1-5).

Finally, the present application indicates that molecular bromine and iodine can be generated by thermal decomposition of a dehydrated salt solution (i.e. a salt) (see page 8, lines 7-12). The current invention optionally uses a salt solution as a salt carrier to a hot flue gas where it is rapidly dehydrated and then thermally decomposed at flue gas temperatures so that its decomposition products can react with mercury (see, for example, page 8, lines 1-12).

The current invention is clearly designed to work at temperatures in excess of the boiling point of aqueous solutions (see page 8, lines 14-16 and Tables 2 and 3).

The temperature range "between 127 and 527°C" is mentioned as "particularly favoured" (see page 8, line 14 to page 9, line 4). This is a temperature range, which is clearly unworkable for the invention disclosed by JP.

In JP-918, Hg is oxidized by a hypochlorite or chlorite containing solution. In contrast, in the present invention liquid may be optionally used in one of two ways:

1. to act as a flowable carrier for a thermolabile molecular halogen precursor, for example, calcium

hypochlorite, which is rapidly evaporated at temperatures well above the boiling point of water; and

1. to capture residual mercury which has missed capture by alkaline solids in the electrostatic precipitators (ESPs), fabric filters (FFs), or baghouses (BHs) (see Example 3 on pages 13 to 15 and page 6 lines 16 to 25).

Both the present invention (see, for example, page 3, line 14 to page 4 line 14, page 6 lines 11 to 14, page 13 lines 16 to 18, page 16 lines 5 to 8) and U.S. Patent No. 6,250,235, (issued to the present inventor and referenced at page 3, line 22 of the present application) put emphasis on retaining the cementitious properties of fly ash crystals and the maintenance of their recyclability with respect to cementitious applications.

If coal fly ash particles were provided to the exhaust gas of the invention of JP-918 as suggested by the Examiner, they would be rendered unsuitable for cementitious applications because the fly ash would be:

- a) hydrated with excessive amounts of water;
- b) excessively contaminated by the oxidation products of sulphur dioxide;
- c) contaminated by the oxidation products of nitrogen oxides; and

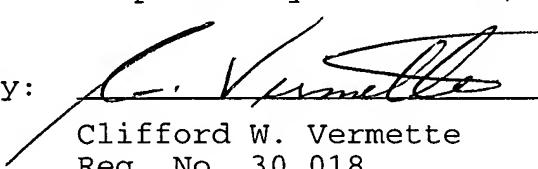
alkali fused fly ash as described in U.S. Patent No. 6,250,235 referenced at page 3, lines 26-28 of the present application) would cause a highly undesirable premature "cement" formation in the JP-918 system causing it to foul undesirably, likely to destruct and render the cementitious fly ash crystal unusable for subsequent cementitious applications (e.g. blended cements). Cementitious crystals can only be hydrated once to achieve their cementitious end-use.

It is respectfully submitted that the present Application is now in condition for allowance. Accordingly, favorable consideration of the Application is respectfully solicited.

Respectfully submitted,

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